Attachment 2

Specifications

DTFAEN-12-R-00083
Remote Transmitter Receiver (RTR) Tower Replacement, West Palm Beach, Florida

DTFAEN-12-R-00083

Remote Transmitter Receiver (RTR) Tower Replacement, West Palm Beach, Florida

Statement of Work

General: Replace 3 of the 5 RTR towers and refurbish 2 towers

Task must include the following and any additional requirements included in the drawings and specifications:

(1) Install a new underground power line from the transformer to the new RTR shelter.

(2) Install 3 each 40' freestanding towers (GFM) complete with grounding.

(3) Install a cable duct from the new RTR Shelter to each tower foundation and continue the conduit to the top of the tower. Install GFM cable from the tower to the shelter.

(4) Refurbish 2 each 40' freestanding towers. Towers shall have all non-structural parts that are rusting replaced and structural members shall be cleaned and painted. Install a cable duct from the new RTR Shelter to each tower foundation and continue the conduit to the top of the tower. Install GFM cable from the tower to the shelter.

(5) Install a complete counterpoise ground system for the new shelter and towers.

(6) Return to the site after the new RTR is made operational and remove the old towers and foundations.

Work by others

(1) Prior to the start of the work, the new RTR Shelter will be placed on the foundation by the manufacturer.

(2) After Completion of the work, the FAA will install the antennas on the towers and the equipment in the shelter. Total time for this phase is 6 to 8 weeks.

Federal Aviation Administration

Remote Transmitter Replacement SPECIFICATIONS WEST PLAM BEACH RTR, West Palm Beach, FL

October 2010

OK-07-232

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SECTION 01100- SUMMARY OF WORK

PART 1 – GENERAL

1.1 SUMMARY

A. The work to be performed under this Contract is shown on the Drawings and defined in the Specifications. This section covers specific information to further clarify the intent and requirements of the contract

B. The DESCRIPTION and SUMMARY paragraphs in each section is a statement or short word summary of the content of the section this paragraph is not intended to scope the section it is merely a brief description of the significant items in the section and is used to simplify the finding of information.

C. The related work paragraphs are also not meant to be all inclusive. Again they serve the function of assisting the reader to locating specific information.

D. Prior to the "Notice to Proceed" specific submittals must be approved by the FAA. See related section 01300 - Submittals for list.

1.2 DEFINITIONS

CO: Contracting Officer
COR: Contracting Officers Representative
RE: Resident Engineer. The RE may also act as the COR
GFM: Government Furnished Material

1.3 QUALITY ASSURANCE

A. The contractor shall provide all labor, materials (with the exception of GFM) and equipment required to perform the work shown on the drawings and described herein. All work preformed and all materials and equipment used will be subject to approval by the COR. This shall include but not be limited to testing, inspection, scheduling, reporting, and submittals.

B. The construction of this facility shall be in accordance with the drawings the contractor shall not use dimensions scaled from the drawings.

C. In the event of a difference among the following contract elements the order of precedence to determine which provisions shall govern is as follows:

1) Written Agreement – includes Contract and all Change Orders
2) Project specifications
3) Project drawings

D. Any discrepancies between the contract provisions, the specifications and the contract drawings shall be referred to the COR for a written determination.

E. Document Sources

Federal Specifications.- The Federal specifications and standards, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government. They may be obtained from the Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Plant, Washington, D.C. 20407.

Publications.- Drawings are available for review at the FAA regional offices.

Copies of military documents may be obtained from the Commanding Officer, Naval Supply Depot, 6801 Tabor Avenue, Philadelphia, Pennsylvania 19120, Attention: Code CDS.

Information on obtaining copies of Federal specifications and standards may also be obtained from General Services Administration offices in Atlanta; Boston; Chicago; Denver; Fort Worth; Houston; Kansas City, Missouri; Los Angeles; New York; Philadelphia; San Francisco; Seattle; and Washington, D.C.

1.4 PROJECT DESCRIPTION

Task shall include the following and any additional requirements included in the drawings and specifications:

General Work at the RTR site: Replace 3 and refurbish 2 of the 5 RTR towers and complete the installation of the shelter.

Install 3 each 40' freestanding towers (GFM) complete with grounding. Install a cable duct from the new RTR Shelter to each tower foundation and continue the conduit to the top of the tower. Install GFM cable from the tower to the shelter.

Refurbish 2 each 40' freestanding towers. Towers shall be have all non-structural parts that are rusting replaced and structural members shall be cleaned and painted. Install a cable duct from the new RTR Shelter to each tower foundation and continue the conduit to the top of the tower. Install GFM cable from the tower to the shelter.

Install a new underground power line from the transformer to the new RTR shelter.

Install a complete counterpoise ground system for the new shelter and towers.

The work also includes the facility grounding system; restorations of areas disturbed during construction and install appurtenances as described herein or indicated on the drawings.

Return to the site after the new RTR is made operational and remove the old towers and foundations.

Work by others:

Prior to the start of the work, the new RTR Shelter will be placed on the foundation by the Shelter Manufacturer.

After Completion of the work, the FAA will install the antennas on the towers and the equipment in the shelter. Total time for this phase is 6 to 8 weeks.

1.5 CONSTRUCTION SCHEDULE

A. The following are the major milestone dates that the contractor is required to meet these dates shall be reflected in the construction schedule required to be submitted by the sections of these specifications

Work Item	Date
1) Contract Award	TBD
2) Key Submittals	1 week after Contract Award
3) Notice to Proceed	Upon Approval of Key Submittals
4) Contractor Mobilization on Site	4 weeks after Contract Award
5) Shelter Delivery	14 calendar days after NTP
6) Contractors Acceptance Inspection	90 calendar days after NTP
7) Return for Demolition	About 90 days after CAI
8) Punchlist Complete (Contract Closeout)	28 calendar days after returning

B. Weather: Make appropriate allowances for any adverse weather conditions which may be reasonably expected during the construction period. No schedule extensions will be granted due to adverse weather. No additional compensation will be paid for the means and measures required to maintain the construction schedule under adverse weather.

C. FAA Furnished Equipment: GFM will consist of the Precast Shelter which will be delivered to the site within 14 days of NTP. The Shelter will be placed on the foundation by the supplier

D. The contractor may demobilize the workforce after item 5 is complete. The contractor shall however be responsible for completing item 7 within 14 calendar days. The contractor site superintendent shall be on site when any work is preformed.

E The contractor shall maintain all items detailed is Specification section 01500

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01010

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SECTION 01200 – SITE ACCESS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following
   1. Site access,
   2. Construction limits,
   3. Use of FAA facilities
   4. Work hours

B. Construction Limits.- The contractor shall confine operations, activities, storage of materials and employee parking within the Remote transmitter (RT) site, as approved by the Contracting Officer. Additional space the contractor deems necessary shall be obtained off site, at no additional cost to the Government

C. Access to Site.- The site is located on the Airport and all employees must be escorted while on site by a contractors representative that has been badged by the local Airport Authority. It is up to the contractor to determine how many employees need to receive badges. The Airport Authority will determine the access gate to minimize the disruption to airport operations.

D. Damage to Site.- Damage to existing paving, lawns, curbs, or sidewalks caused by the contractor's activities shall be repaired. All costs of repairs shall be paid by the contractor. After notice to proceed and prior to the commencement of construction, the contractor and COR shall conduct joint inspections of the existing areas affected by the construction. Existing damage or defects shall be noted and will be used a the basis for determination of damages caused by the contractor's operations.

E. Inspection of Site by Contractor.- The contractor shall have carefully examined the premises to determine the extent of work and the conditions under which it must be done. On request to the COR, the contractor may obtain permission to make soil borings or probings.

F. Contractor's Use of Premises.- Contractor shall have shared use of the premises within the construction staging area limits for the execution of the work. Contractor shall assume full responsibility for the protection and safekeeping of products stored on the site. The contractor and subcontractors shall maintain the job site in a neat and orderly condition. This includes the daily removal of rubbish, waste and tools, equipment and materials not required for the work in progress.

G. Government Use and Access to Premises.- The Government reserves the right to enter the premises during the term of the contract for periodic work inspections. See Part I, Section F, FAR Clause 52.236.8 "Other Contracts" for work by other contractors.

H. Security Requirements

   1. Personnel List.- Contractor shall provide the COR with a list of contractor's personnel who will require access to the site. The list shall be kept current during project work.

2. Contractors personnel shall complete the training and wecurity requirements set forth by the Palm Beach Airport Authority

3. Security Investigation.- Contractor's personnel may be subject to security investigation by FAA. Upon request by the Resident Engineer, the contractor shall promptly complete all security forms provided by the COR.

4. Right to Search.- Current procedures at FAA facilities located within airport boundaries include the "right to search." If in the judgment of the authorized security guard a cause to search a vehicle or the person of personnel exists, such search will be made.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01020

SECTION 01300 – COORDINATION, LOCAL PERMITS AND TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following
   1. Project coordination among the various trades
   2. Local Permits for Construction
   3. Testing of Construction Materials

B. Related Sections and documents
   1. Section 02315 – Excavating and Backfilling

C. Project Coordination.- The contractor shall prepare a detailed schedule of work and work layout to resolve conflicts and to ensure coordination of the work by different trades. It shall be the duty of the contractor to resolve all coordination conflicts that arise among his subcontractors.

D. Local Permits.- The contractor shall apply, pay fees, etc., to obtain local building permits and inspection as required. See Part I, Section F, FAR Clause 52.236.7 for additional information.

E. Applicable Documents.- The current issues of the following documents in effect on the date of the invitation for bid form a part of this specification and are applicable to the extend specified herein.

American Association of State Highway and Transportation Officials (AASHTO)

T99	Moisture Density Relations of Soils Using a 5.5-Pound Rammer and 12-Inch Drop
T191	Density of Soil in-Place by the Sand-Cone Method
T205	Density of Soil in-Place by the Rubber Balloon Method
T238	Density of Soil and Soil Aggregate by Nuclear Method (Shallow Depth)
M145	Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

F. Testing

1. Contractor's Responsibility.- Cooperate with the testing laboratory and make available, without cost, samples of all materials to be tested. Contractor shall furnish such normal labor as is necessary to obtain samples at the project site and to assist in making slump tests, casting and curing concrete cylinders. Contractor shall advise the testing laboratory of the identity of material sources and instruct these suppliers to allow inspections by the laboratory representatives, and notify the testing laboratory sufficiently in advance of operations to allow for completion of initial tests and assignment of inspection personnel.

2. Selection and Payment.- The contractor shall select and pay for a qualified testing laboratory or laboratories to perform the requirements of this section.

3. Rejected Materials or Workmanship.- All materials or workmanship or both which have been rejected by the COR by reasons of failure to conform to the requirements of the Contract Documents shall be removed and replaced with new, acceptable materials by the contractor at contractor's own expense. Contractor shall pay for testing of new materials, which have been installed in place of rejected materials.

4. Test Reports.- The testing laboratory shall furnish three copies of each report direct to the COR covering all of its determinations and all of its control services. Reports shall show all data customarily listed by the laboratory in reporting on quantities, qualities, and types of materials, together with their location in the project and applicable Specification Section. Form of reports shall be acceptable to the COR.

5. Testing Procedures

    i. General.- No soil borings were taken by the FAA for this project. FAA does not expect to have any borrow material brought in for this project. The antenna tower foundations are designed for the concrete to be place on an undisturbed excavated area having a bearing of 2000 psf. If the contractor encounters unsuitable materials while excavating, the contractor shall notify both the resident engineer and the contracting officer. Concrete testing shall be the responsibility of the contractor. The FAA reserves the right to direct retesting in the event of failures and any retesting shall be at contractor's expense.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01300

SECTION 01330– SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

Prior to Notice to Proceed.- Specific shop drawings and/or submittal data currently listed and required by the various sections of this specification shall be submitted to the COR for approval. The following submittal items must be approved by the FAA prior to the Notice to Proceed:

Construction schedule, concrete mix design, reinforcing steel, door, frame and hardware, HVAC equipment, metal roof materials/guarantee and electrical equipment.

1.1.1 Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.1.2 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

SD-01 Preconstruction Submittals

Schedule of Prices
Reinforcing Steel
Concrete Mix Design
Electrical Equipment
List of proposed subcontractors

SD-02 Shop Drawings

Not Used

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Not Used

SD-05 Design Data

Calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Not Used

SD-10 Operation and Maintenance Data

Not Used

SD-11 Closeout Submittals

Not Used

1.1.3 Approving Authority

Office authorized to approve submittal.

1.2 SUBMITTALS

Government approval is required for submittals:

1.3 USE OF SUBMITTAL REGISTER

Not used

1.4 PROCEDURES FOR SUBMITTALS

1.4.1 Reviewing, Certifying, Approving Authority

Contractor shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements.

1.4.2 Constraints

a. Submittals listed or specified in this contract shall conform to provisions of this section, unless explicitly stated otherwise.

b. Submittals shall be complete for each definable feature of work; components of definable feature interrelated as a system shall be submitted at same time.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.4.3 Scheduling

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.

b. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for COR approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from the Contractor. Period of review for each resubmittal is the same as for initial submittal.

1.4.4 Variations

Variations from contract requirements require Government approval pursuant to contract Clause entitled "FAR 52.236-21, Specifications and Drawings for Construction" and will be considered where advantageous to Government.

1.4.4.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

1.4.4.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost saving. In addition to

documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.4.4.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.4.4.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 5 working days will be allowed for consideration by the Government of submittals with variations.

1.4.5 Contractor's Responsibilities

a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.

b. Transmit submittals to COR in accordance with schedule and to prevent delays in the work, delays to Government, or delays to separate Contractors.

c. Advise Contracting Officer of variation, as required by paragraph entitled "Variations."

d. Correct and resubmit submittal as directed by approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the Contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.

e. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted", except to the extent that a portion of work must be accomplished as basis of submittal.

1.4.7 Government's Responsibilities

When approving authority is Contracting Officer, the Government will:

a. Note date on which submittal was received from Contractor, on each submittal for which the Contracting Officer is approving authority.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled "Actions Possible" and with markings appropriate for action indicated.

1.4.8 Actions Possible

Submittals will be returned with one of the following notations:

a. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required , does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

b. Submittals marked "approved" "approved as submitted" authorize Contractor to proceed with work covered.

c. Submittals marked "approved as noted" or "approval except as noted; resubmission not required" authorize Contractor to proceed with work as noted provided Contractor takes no exception to the notations.

d. Submittals marked "revise and resubmit" or "disapproved" indicate submittal is incomplete or does not comply with design concept or requirements of the contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until resubmittal is approved.

1.5 FORMAT OF SUBMITTALS

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. The transmittal form shall identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.5.2 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction contract number.

c. Section number of the specification section by which submittal is required.

d. Submittal description (SD) number of each component of submittal.

e. When a resubmission, add alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.

f. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.

g. Product identification and location in project.

1.5.3 Format for SD-02 Shop Drawings

Not Used

1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instruction's

a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates..

d. Provide product data in metric dimensions. Where product data are included in preprinted catalogs with English units only, submit metric dimensions on separate sheet.

e. Product data shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for SD-07 Certificates.

f. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

g. Submit manufacturer's instruction prior to installation.

1.5.5 Format of SD-04 Samples

Not Used

1.5.6 Format of SD-05 Design Data and SD-07 Certificates

a. Provide design data and certificates on 297 by 210 mm 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

A. Provide reports on 297 by 210 mm 8 1/2 by 11 inches paper in a complete bound volume.

B. Indicate by prominent notation, each report in the submittal. Indicate specification number and pararaph number to which it pertains.

1.5.8 Format of SD-10 Operation and Maintenance (O&M) Data

Not Used.

1.5.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittalss

A. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

B. Provide all dimensions in administrative submittals in metric. Where data are included in preprinted material with English units only, submit metric dimensions on separate sheet.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of SD-02 Shop Drawings

Not Used

1.6.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 SD-04 Number of Samples

Not Used

1.6.4 Number of Copies SD-05 Design Data and SD-07 Certificates

a. Submit three copies of submittals of shop drawings requiring review and approval by Contracting Officer.

1.6.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reportss

a. Submit three copies of submittals of shop drawings requiring review and approval by Contracting Officer.

1.6.6 Number of Copies of SD-10 Operation and Maintenance Data

Not Used

1.6.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11Closeout Submittalss

a. Submit three copies of submittals of shop drawings requiring review and approval by Contracting Officer.

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1.7 FORWARDING SUBMITTALS

1.7.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to the Contracting Officer The Project Enginner will review and approve for the Contracting Officer prior to the notice to Proceed. After the notice to Proceed all submittals shall be forwarded to the Resident Enginneer in Charge of Construction.

1.7.1.1 O&M Data

COR will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements.; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

1.8 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.9 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal.The Contractor shall make all corrections required by the Contracting Officer, obtain the Designer of Record's approval when applicable, and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Any "information only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal shall be resubmitted as one requiring "approval" action, requiring both Designer of Record and Government approval. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.10 GENERAL

The Contractor shall make submittals as required by the specifications. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked, and each item shall be stamped, signed, and dated by the Contractor. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.11 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

1.11.1 Procedures

The Government will further discuss detailed submittal procedures with the Contractor at the Post-Award Conference.

1.11.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.12 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. 3 copies of the submittal will be retained by the Contracting Officer and the remaining copies of the submittal will be returned to the Contractor.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01330

SUBMITTAL SCHEDULE		Preconstruction	Shop Drawings	Product Data	Samples	Design Data	Test reports	Certificates	Manufacturer's Instructions	Manufacturer's Field Reports	O & M Data	Closeout
Section	Item	01	02	03	04	05	06	07	08	09	10	11
DIVISION 1 - GENERAL REQUIREMENTS												
	Construction Progress Schedule	X										
	Personnel List	X										
	List of proposed subcontractors	X										
DIVISION 2 -SITEWORK												
02300	E, B & C FOR STRUCTURES						X					
02312	E, B & C FOR UTILITIES						X					
DIVISION 3 - CONCRETE												
03300	CAST IN PLACE CONCRETE	X				X	X	X				
DIVISION 16 - ELECTRICAL												
16100	ELECTRICAL WORK	X		X			X		X			
16200	UNDERGROUND CABLES	X		X								

SECTION 01500 – TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NFPA 70(2005) National Electrical Code

1.2 TEMPORARY UTILITIES

A. Contractor shall provide and pay for all temporary services and facilities as specified below and as necessary for the proper and expeditious execution of the work. Contractor shall make, or have made, all connections to existing services and sources of supply as necessary and/or indicated and pay all charges for same. Contractor shall provide all labor, materials, equipment and appurtenances necessary for the complete installation, operation and maintenance of all temporary service systems and facilities. All work under this section shall comply with applicable laws, rules, regulations, codes, ordinances and orders of all federal, state and local authorities having jurisdiction for the safety of persons, materials and property. Contractor shall remove all such temporary installations and connections when no longer necessary for the project work.

B. Temporary Electric Lighting and Power.- Contractor shall provide and maintain a temporary lighting and power system for construction and inspection purposes. Contractor shall make all necessary arrangement for temporary electrical services with the local power company to provide and pay for all temporary engine generator at the project site.

C. Temporary Water.- Contractor shall make arrangements to furnish a potable water supply for project work, and pay for all temporary water and services.

D. Temporary Toilets and Sanitation.- Contractor shall provide ample and suitable onsite sanitary conveniences with proper enclosures for the use of the workers employed on the work. Such conveniences shall be kept clean, be properly ventilated and shall be installed and maintained in conformity with requirements of all laws and ordinances governing such installations. Locations shall be subject to COR approval. After completion of the work such conveniences shall be removed from the site.

E. Toilets.- Toilets shall be portable chemical type with screened enclosures, each having a urinal and closet and mounted on skids. Not less than one unit shall be provided for every 25 full-time employees.

F. Toilet Servicing.- Contractor shall be responsible for paying and arranging for each toilet unit to be serviced at least twice a week, including removal of waste matter, sterilizing, recharging tank, refilling tissue holders, and thorough cleaning and scrubbing of entire interior.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01500

SECTION 01600 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

Material and equipment incorporated into the work shall conform to applicable specifications and standards and comply with size, make, type and quality specified, or as specifically approved in writing by the COR.

1.2 REFERENCES - Not Used

1.3 SUBMITTALS - Not Used

1.4 SHIPMENT AND PROTECTION OF MATERIAL AND EQUIPMENT

Shipments shall be addressed to the Contractor who shall be responsible for their receipt, unloading, handling, and storage at the site. Government will not accept deliveries on behalf of the Contractor or his subcontractors or assume responsibility for security of materials, equipment, or supplies delivered to the site.

Products shall be delivered in undamaged condition, in manufacturer's original containers or packing, with identifying labels intact and legible. Shipments shall be inspected to ensure compliance with requirements of contract documents and approved submittals, and that products are properly protected and undamaged immediately on delivery. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packing.

Contractor shall protect and preserve materials, supplies, and equipment of every description (including property which may be Government-furnished or -owned) and work performed.

1.5 STORAGE AND PROTECTION OF MATERIAL

Only material and construction equipment designated for performance of contract work may be stored at the construction site.

Products shall be stored in accordance with manufacturer's instructions, with seals and labels intact and legible.

Products subject to damage by the elements shall be stored in weather-tight enclosures. Temperatures and humidity shall be maintained within the ranges required by the manufacturers instructions.

Fabricated products shall be stored above the ground, on blocking or skids to prevent soiling or staining. Products which are subject to deterioration shall be covered with impervious sheet coverings; adequate ventilation shall be provided to avoid condensation.

Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment to be provided under this contract shall be standard catalogue products of manufacturers regularly engaged in the manufacture of the products. All material "cut sheets" and factory acceptance test data shall be provided to the Contracting Officer. Information and data shall have a cover letter/sheet clearly marked with the system name, date, and the words "Final Test Data - Forward for inclusion in the Maintenance Database."

Material and equipment shall be installed in accordance with the requirements of the contract drawings , contract specifications and referenced standards and specifications.

Manufactured and fabricated products shall be designed, fabricated and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges and shall be interchangeable. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.

Products shall be suitable for service conditions. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing. Do not use material or equipment for any purpose other than for which it is designed or specified.

Furnish and install products specified, under options and conditions for substitution stated in this section.

2.1 MANUFACTURER'S INSTRUCTIONS

When contract documents require that installation of work shall comply with manufacturer's printed instructions, copies of such instructions shall be distributed to parties involved in the installation, including two copies to the COR.

Maintain one set of complete instructions at the job site during installation and until completion.

Products shall be handled, installed, connected, cleaned and conditioned in strict accordance with such instructions and in conformity with specified requirements. If job conditions or specified requirements conflict with manufacturer's instructions, the contractor shall consult with the COR for further instructions.

All work shall be performed in accordance with manufacturer's instructions. No preparatory step or installation procedure shall be omitted unless specifically modified or exempted by contract documents.

PART 3 - EXECUTION

Not Used

END OF SECTION 01600

SECTION 01700 – CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of each section of the specifications.

1.2 REFERENCES

Not Used

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with each section of the project's specification:

SD-01 Contract Documents

The following shall be submitted in accordance with paragraph entitled, "General," of this section.

1. Contract Documents
2. Contract Drawings
3. Contractor Specifications and Addenda

SD-02 Shop Drawings

Not Used

SD-03 Product Data

Spare Parts Data shall indicate manufacturer's name, part number, nomenclature, and stock level recommended for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

SD-07 Certificates

A Work Plan shall be submitted in accordance with paragraph entitled, "General," of this section.

SD-08 Manufacturer's Instructions

The following shall be submitted in accordance with paragraph entitled, "General," of this section.

Preventative Maintenance and Condition Monitoring (Predictive Testing) and Inspection schedules shall be submitted by the Contractor with instructions that state when systems should be retested.

Posted Instructions

SD-10 Operation and Maintenance Data

Not Used

1.4 GENERAL

1.4.1 Project Record Documents

A. Maintenance of Documents.- The following documents shall be maintained at the project site: Contract drawings, contract specification, reviewed shop drawings, change orders, field test reports, project correspondence, other modifications to contract.

B. Storage and Use of Documents.- Store record documents apart from documents used for construction; do not use record documents for construction purposes. Keep documents in clean, dry, legible condition; provide file cabinets and racks for storage of drawings.

C. Marking Devices.- Use red colored pencil for all marking.

D. Recording and Labeling.- Label each document "Project Record" in 1-inch high printed block letters. Keep record documents current. Do not conceal or cover up any item of work until the information has been recorded.

E. Submittals.- At completion of project, deliver record documents to COR with a transmittal letter, per Section 01330

F. Contract Drawings.- Legibly mark to record actual construction:

1. Depths of various elements of foundation in relation to grade floor level

2. Horizontal and vertical location of underground and overhead utilities and appurtenances referenced to permanent surface improvements

3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure

4. Field changes of dimension and detail

5. Changes made by change order or field order

6. Details not on originally specified drawings.

G. Contractor Specifications and Addenda.- Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each item of equipment actually installed.

2. Changes made by change order or field order.

3. Other matters not originally specified.

1.4.2 Shop Drawings.

Not Used.

1.4.3 Completion Certificate

When the work is complete, submit written certification that: Contract documents have been reviewed; work has been inspected for compliance with contract; equipment and systems have been tested in the presence of the COR and are operational; required operation and maintenance manuals, data, and parts list have been submitted and approved; spare parts have been provided as required; and required instruction of maintenance personnel had been accomplished.

1.4.4 Operating Instructions and Spare Parts

Posted Instructions shall be submitted by the Contractor with labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Contractor shall submit 3 copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

Spare Parts Data shall indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

Contractor shall supply as indicated in each section of the specification. Provision of spare parts does not relieve the Contractor of responsibilities listed under the contract guarantee provisions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals shall be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Information shall be bound in manual format and grouped by technical sections. Test data shall be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals shall have 0.3937-inch 10 millimeter holes and be bound in 3-ring, loose-leaf binders. Data shall be organized by separate index and tabbed sheets, in a loose-leaf binder. Binder shall lie flat with printed sheets that are easy to read. Caution and warning indications shall be clearly labeled.

Contractor shall submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services shall be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer shall be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, shall be made available to the Contracting Officer.

The contractor shall require each subcontractor engaged upon the work to bear full responsibility for cleaning up during and immediately upon completion of his work. All rubbish, waste, tools, equipment and other apparatus caused by or used in the execution of his work shall be removed. This shall in no way be construed to relieve the contractor of his primary responsibility for maintaining the building and the site clean and free of debris, and leaving all work in a clean and proper condition acceptable to the COR.

All exposed floor surfaces shall be protected against all mechanical damage, mortar or plaster droppings, oil, grease, or other damage that will stain or soil the cement finish. Protection shall be maintained until all work has been completed.

3.2 Rubbish Removal

Immediately after unpacking, all packing material, case lumber, wrappings, or other rubbish, flammable or otherwise, shall be collected and removed from the building and the premises.

3.3 Overall Cleaning

Immediately before the final inspection, the entire exterior and interior of the building and the surrounding areas shall be thoroughly cleaned by the contractor, including but not limited to the following:

All construction facilities, debris and rubbish shall be removed from all buildings and the sites.

All finished surfaces within the buildings shall be swept, dusted, vacuumed, washed or polished as required.

All tools, scaffolding, temporary utility connections or buildings, belonging to the contractor or used under his direction shall be removed from the site.

3.4 Final Inspection

The COR will schedule the final inspection upon approval and endorsement of the contractor's Completion Certification.

3.5 Punch List.

The COR will furnish the contractor with a list of discrepancies in the work, material and equipment noted during the final inspection.

3.6 Acceptance of Work

The contractor shall correct discrepancies noted during the final inspection, clean the premises and notify the COR that the work is ready for acceptance.

END OF SECTION 01700

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SECTION 02300 - EXCAVATING, BACKFILLING, AND COMPACTING FOR STRUCTURES

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145	Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASTM INTERNATIONAL (ASTM)

ASTM D698	Standard Proctor Compaction Test
ASTM D 2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-06 Test Reports

Test Reports shall be submitted for Soil Test results within 7 calendar days. Test reports shall be submitted according to paragraph entitled, "Quality Control Testing During Construction," of this section.

1.3 LIMITS OF CONSTRUCTION

Work in this section relates to excavation, fill, and backfill to a point 5 feet beyond the building or structure line.

1.4 SAMPLING AND TESTING

1.4.1 Soil Test and Inspection Service

A certified soil-testing service shall be provided by the Contractor. Testing shall include sampling and testing soil materials proposed for use in the work, and field-testing facilities for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

PART 2 - PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

Backfill material shall consist of sandy clay, sand, gravel, soft shale, or other satisfactory soil materials.

2.2.1 Proposed Soil Materials

A. Crushed Stone

Type and Size.- Crushed stone shall consist of crushed gravel or crushed rock which is hard, strong, durable, free from adherent coatings, and shall contain no soft, thin, or elongated pieces or organic material. Material shall be secured from an acceptable source off-site. 1-1/2 inch maximum particle size and maximum 2 percent by weight passing size 4 sieve.

B. Earth Fill

Fill shall be well graded inorganic fill, with 100 percent passing a 3-inch sieve, and 5 percent to 15 percent passing a No. 200 sieve, and having a plasticity index of 12 or less.

C. Borrow

Excavated material from the site that is suitable as approved by the COR, may be used for filling or backfilling. Procure any additional material as necessary for site fill from approved borrow pits.

D. Filtration/Separation Fabric.-

A non-woven fabric, needle punched and heat fused of 100 percent polypropylene staple fiber; permeable to moisture transmittal, minimum 4.5 ounces per square yard; and conforming to the following additional criteria:

Grab strength, length direction. lb. = 90 Grab strength, width direction, lb. = 110 Elongation at break, length direction, percentage 65 Elongation at break, width direction, percentage 65 Coefficient of permeability K, c/Sec 5 x 102.

2.1.1 Satisfactory Materials

Satisfactory materials shall mean AASHTO M 145, (ASTM D 3282) Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

2.1.2 Unsatisfactory Materials

Unsatisfactory soil materials shall mean AASHTO M 145, Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soil, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.2 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam.

The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable materials larger than 2 inches in any dimension.

2.3 COHESIONLESS MATERIALS

Cohesionless soil materials include gravels, gravel-sand mixtures, sands, and gravelly-sands. Moisture-density relations of compacted cohesionless soils, when plotted on graphs, will show straight lines or reverse-shaped moisture density curves.

2.4 COHESIVE MATERIALS

Cohesive soil materials include clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands. Moisture-density relations of compacted cohesive soils, when plotted on graphs, will show normal moisture-density curves.

2.5 SUBBASE MATERIAL

Subbase material shall be a naturally or artificially graded mixture of natural or crushed gravel, crushed stone, or sand.

2.6 DRAINAGE FILL

Drainage fill shall be a washed, uniformly graded mixture of crushed stone or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 4 sieve.

2.7 FILTERING MATERIAL

Filtering material shall conform to ASTM C 33 and shall be a uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand, with 100 percent passing 3/8-inch sieve and 2 to 10 percent passing a No. 100 sieve.

2.8 SAND

Sand shall be natural sand.

PART 3 - EXECUTION

3.1 PREPARATION

Before earthwork is started, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

3.2 UNAUTHORIZED EXCAVATION

Unauthorized excavation shall consist of removal of materials beyond indicated subgrade elevations or side dimensions specified without specific direction and shall be replaced as specified at no additional cost to the Government.

Unauthorized excavation under foundations or retaining walls shall be filled by lowering the bottom elevation of the footing or base to the excavation bottom without altering the approved top elevation.

Elsewhere unauthorized excavations shall be backfilled and compacted as specified for authorized excavations of the same classification.

3.3 SHORING AND BRACING

Shoring and bracing in excavations shall be maintained regardless of the length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

3.4 WATER REMOVAL

Water shall not be permitted to accumulate in excavations, or flood the site and surrounding area. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.5 MATERIAL STORAGE

Excavated materials classified as satisfactory soil material shall be stockpiled, where directed, until required for backfill or fill. Stockpiles shall be placed, graded, and shaped for proper drainage.

Materials required in the work shall be located and retained a sufficient distance from the edge of excavations to prevent such material falling or sliding back into the excavations and to prevent cave-ins.

3.6 EXCAVATION FOR STRUCTURES

Excavation for structures shall conform to the dimensions and elevations indicated within a tolerance of plus or minus 0.10 foot and shall extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall be done just before concrete is placed. Bottoms shall be trimmed to the required lines and grades to leave a solid bed to receive concrete.

3.8 REMOVAL OF UNSATISFACTORY SOIL MATERIALS

Unsatisfactory soil materials encountered that extend below the required elevations shall be excavated to the depth directed.

3.12 FILLING AND BACKFILLING

3.12.1 Preparations Prior to Backfill Placement

Excavations shall be backfilled as promptly as the work permits but not until completion of the following:

Approval of construction below finish grade

Inspection, testing, approval, and recording location of underground utilities

Removal of concrete formwork

Removal of shoring and bracing; backfilling of voids with satisfactory soil material; temporary sheet piling driven below bottom of structures; and cutting off and removing of utilities in a manner that prevents settlement of the structure or utilities

Removal of trash and debris

Completion of concrete waterproofing

3.12.2 Preparation of Ground Surface to Receive Fill

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the placement of fills. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stripped, or broken up in such manner that fill material will bond with the existing material.

When the ground surface has a density less than that specified for the particular area classification, the ground surface shall be broken up, pulverized, moisture-conditioned to near optimum moisture content of the soil material, and compacted to the required depth and percentage of maximum density.

3.12.3 Placement and Compaction

Backfill and fill materials shall be placed in layers not more than 6 inches in loose depth. Before compaction, each layer of backfill or fill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material and shall then be compacted to the percentage of maximum density for each area classification as specified. Backfill or fill material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Backfill and fill materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated elevations.

Compaction adjacent to structures, within a horizontal distance from the face of the structure equal to the depth of backfill or fill material (measured from the bottom of footing or bottom of foundation or retaining wall) to final grade, shall be done with power-driven hand tampers.

3.13 COMPACTION

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in AASHTO T 180, Methods B or D.

3.13.1 Percentage of Maximum Density Requirements

Actual density of each layer of soil material-in-place shall be not less than the following percentages of the maximum density of the same soil material determined by the moisture-density test specified.

PERCENT MAXIMUM DENSITY

AREA CLASSIFICATION	ASTM D 698
Structures	98
Building slabs and steps	98
Top 12 inches of subgrade and each layer of backfill material	95

3.13.2 Moisture Control

Moisture content in soil material at time of compaction shall be within limits specified.

Where the moisture content of a layer of soil material is below optimum before compaction, the required amount of water shall be uniformly applied to the surface of the layer of soil material and the layer of soil disked or otherwise mixed until a uniform moisture content is reached.

Moisture of a layer of soil material that is above optimum shall be removed by drying.

3.14 GRADING

Areas within the limits of grading under this section, including adjacent transition areas, shall be uniformly graded. Finished surface shall be smooth within the specified tolerances, compacted, and

with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

3.14.1 Grading Outside Building Lines

Areas outside the building lines for each structure shall be hand-graded to drain away from the structure and to prevent ponding of water after rains. Finished surface shall be within the tolerance specified below for each area classification, compacted as specified, and free from irregular surface changes.

Walks:

Surface of areas under walks shall be shaped to line, grade, and cross section; finished surface shall be not more than 0.0 foot above or 0.10 foot below the indicated finish elevation.

3.14.2 Grading Surface of Fill Under Structures

Surface of fill under building slabs shall be smooth and even, free of voids, compacted as specified and to indicated grade within the specified tolerances. When tested with a 10-foot straightedge, parallel with and at right angles to the building lines, the finished surface shall show no deviation in excess of 1 inch

3.15 MAINTENANCE

3.15.1 Protection of Graded Areas

Newly graded areas shall be protected from traffic and erosion and shall be maintained free of trash and debris.

3.15.2 Reconditioning Compacted Areas

Where approved compacted areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified, reshaped, and compacted as specified to the required density prior to further construction.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

Excess excavated satisfactory materials shall be removed from Government property.

Waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris, shall be removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor

END OF SECTION 02300

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SECTION 02312- EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145	Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASTM INTERNATIONAL (ASTM)

ASTM D698	Standard Proctor Compaction Test
ASTM D 2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-06 Test Reports

Test reports shall be submitted in writing by the Contractor for Soil Test results within 5 calendar days. Reports shall be according to paragraph entitled, "Field Quality Control," of this section.

1.3 QUALITY ASSURANCE

Soil survey for satisfactory soil materials and samples of soil materials shall be furnished by the Contractor. A certified soil-testing service approved by the Contracting Officer shall be provided by the Contractor. Testing shall include soil survey for satisfactory soil materials, sampling and testing soil materials proposed for use in the work, subbase materials at the mixing plant, and field-testing facilities for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

PART 2 - PRODUCTS

2.1 STRUCTURAL MATERIALS

Materials used for shoring and bracing, such as sheet piling, uprights, stringers, and crossbraces, shall be in good serviceable condition. Any timber used shall be sound and free from large or loose knots.

2.2 BACKFILL MATERIAL

Backfill material shall consist of sandy clay, sand, gravel, soft shale, or other satisfactory soil materials.

2.2.1 Proposed Soil Materials

A. Crushed Stone

Type and Size.- Crushed stone shall consist of crushed gravel or crushed rock which is hard, strong, durable, free from adherent coatings, and shall contain no soft, thin, or elongated pieces or organic material. Material shall be secured from an acceptable source off-site. 1-1/2 inch maximum particle size and maximum 2 percent by weight passing size 4 sieve.

B. Earth Fill

Fill shall be well graded inorganic fill, with 100 percent passing a 3-inch sieve, and 5 percent to 15 percent passing a No. 200 sieve, and having a plasticity index of 12 or less.

C. Borrow

Excavated material from the site that is suitable as approved by the COR, may be used for filling or backfilling. Procure any additional material as necessary for site fill from approved borrow pits.

D. Filtration/Separation Fabric.-

A non-woven fabric, needle punched and heat fused of 100 percent polypropylene staple fiber; permeable to moisture transmittal, minimum 4.5 ounces per square yard; and conforming to the following additional criteria:

Grab strength, length direction. lb. = 90 Grab strength, width direction, lb. = 110 Elongation at break, length direction, percentage 65 Elongation at break, width direction, percentage 65 Coefficient of permeability K, c/Sec 5 x 102.

2.2.2 Satisfactory Materials

Satisfactory soil materials - AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

2.2.3 Unsatisfactory Materials

Unsatisfactory soil materials - AASHTO M 145 Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, highly organic soils, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.3 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam. The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable materials larger than 2 inch 50 millimeter in any dimension.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Before starting earthwork, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

Excavation, filling, backfilling, and grading shall be to subgrade elevations specified.

Excavated materials suitable for backfill shall be piled in an orderly manner sufficiently distant from excavations to prevent overloading, slides, and cave-ins.

Excavations shall be done in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

3.2 PROTECTION OF PERSONS AND PROPERTY

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage including settlement, lateral movement, undermining, and washout.

Topsoil removal operations shall be conducted to ensure safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

3.3 SHORING, BRACING, AND SHEETING

Shoring and bracing in excavations shall be maintained for the entire length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

Sheeting used to prevent lateral movement of soil shall be removed in accordance with the requirements.

Untreated sheeting shall not be left in place beneath structures or pavements.

3.4 TRENCH EXCAVATION

Trenches shall be of adequate width and depth for the specified purpose. Side slopes of the trenches shall be as nearly vertical as practicable. Care shall be taken not to overexcavate. Bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length. Stones shall be removed, as necessary, to avoid point bearing. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6-inches below the trench depth specified. Except as specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe, as determined by the COR, is encountered in the bottom of the trench, it shall be removed and the trench shall be backfilled to the proper grade with coarse sand, fine gravel, or other suitable, approved material.

Trench excavations in surfaced areas shall be by open cut, unless otherwise shown. The pavement shall be cut by concrete saw or other approved method. Cuts shall be in straight lines parallel to the utility line location and shall be to a depth of at least one quarter of the pavement thickness. The remainder of the pavement shall be broken out. Pavement shall be removed a minimum of 12 inches on each side of the trench and 6 inches beyond where the base course is to be removed.

3.5 WATER REMOVAL

Water shall not be permitted to accumulate in excavations. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.6 EXCAVATION FOR ELECTRICAL UTILITIES, GROUNDING AND FAA CABLE

Excavation of trenches for electrical cables and duct lines shall provide vertical walls, unless otherwise approved by the Contracting Officer, and the trench shall be only as wide as necessary for workers to install the cables or ducts. Abrupt changes in grade of the trench bottom shall be avoided. Trenches shall be of a depth to provide a minimum cover over the top of the cables or ducts of 2-feet below finished grade, and at additional depth if necessary to avoid interference of the electrical cables or ducts with other utilities.

3.7 BACKFILLING AND COMPACTION

Where trench sheeting is pulled, withdrawal shall be in increments of not more than 1 foot and backfilling and compaction operations shall be carried on simultaneously with trench sheeting pulling.

Trenches shall not be backfilled until required tests are performed and until the utilities systems, as installed, conform to the requirements for the installation of the various utilities. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

3.7.1 Bedding

Where the trench is excavated in rocks, a minimum of 6 inches of specified bedding material shall be placed on the rock surface before laying conduit or electrical cable.

3.7.2 Backfill Around Pipe

Backfill around pipe shall be applied to 6-inches above pipe with the specified bedding material.

3.7.3 Lower Portion of Trench

Backfill material shall be deposited in 8-inch uncompacted layers and compacted to the density of the adjacent soil until there is a cover of not less than 1 foot . The backfill material in this portion of the trench shall consist of sandy clay, sand, gravel, soft shale, or other approved materials, free from hard clods and stones larger than 1 inch in any dimension.

3.7.4 Remainder of Trench

The remainder of the trench shall be backfilled with material that is free of stones larger than 3 inches in any dimension. Backfill material shall be deposited in layers not exceeding the thickness specified, and each layer shall be compacted to the minimum density specified.

Under concrete slabs and paved parking areas:

6-inch , 95 percent of maximum density

Under other areas:

8-inch layers, 90 percent of maximum density

3.8 FIELD QUALITY CONTROL

The Contractor shall arrange his Soil Test work so that sampling and testing may be performed without interruption. Moisture-density relations shall be determined in accordance with AASHTO T 180, Method B or D. Field density tests shall be performed by methods in sufficient number to ensure that the specified density is obtained.

Soil materials shall be tested during construction as follows:

MATERIAL	REQUIREMENT	TEST METHOD	MATERIAL TESTED AND NUMBER OF TESTS
Soil material in place after compaction	Density of soil-in-place	ASTM D 698Standard Proctor Compaction Test or ASTM D 2922 Nuclear Method when approved by Contracting Officer	At least threedaily for eachsubgrade soil material, andfor each layer of soil material; additional test whenever there is moisture

3.14 RESTORATION OF SURFACES

Areas within the limits of earthwork under this section, including adjacent transition areas, shall be uniformly graded. The finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

3.14.1 Grassed areas:

The finished surface of areas to receive topsoil blend shall be not more than 0.10-foot 30 millimeter above or below the specified finish elevations.

3.14.2 Walks:

The surface of areas under walks shall be shaped to line, grade, and cross section, and the finished surface shall be not more then 0.0 foot millimeter above or 0.10-foot 30 millimeter below the specified finish elevations.

3.14.3 Pavements:

The surface of areas under pavements shall be shaped to line, grade, and cross section, and the finished surface shall be not more than 1/2-inch 13 millimeter above or below the specified finish elevations.

3.15 DISPOSAL OF EXCESS AND WASTE MATERIALS

Waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris, shall be removed from Government property and legally disposed of, by the Contractor.

END OF SECTION 02312

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 117(1990) Standard Specification for Tolerances for Concrete Construction and Materials

ACI 302.1R(1996) Guide for Concrete Floor and Slab Construction

ACI 304R(2000) Guide for Measuring, Mixing, Transporting, and Placing Concrete

ACI 305R(1999) Hot Weather Concreting

ACI 306R(1999) Cold Weather Concreting

ACI 308R(2001) Standard Practice for Curing Concrete

ACI 315(1999) Details and Detailing of Concrete Reinforcement

ACI 318/318R(2002) Building Code Requirements for Structural Concrete and Commentary

ACI 347R(2003) Guide to Formwork for Concrete

ASTM INTERNATIONAL (ASTM)

ASTM A 185(2002) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A 615/A 615M(2004) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 1064/C 1064M(2003) Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

ASTM C 143/C 143M(2003) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C 150(2004a) Standard Specification for Portland Cement

ASTM C 172(1999) Standard Practice for Sampling Freshly Mixed Concrete

ASTM C 231(2003) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 260(2001) Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C 309(2003) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C 31(2000e1) Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C 39/C 39M(2003) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C 494/C 494M(2004) Standard Specification for Chemical Admixtures for Concrete

ASTM C 618(2003) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

ASTM C 94/C 94M(2003a) Standard Specification for Ready-Mixed Concrete

ASTM C 989(2004) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

ASTM D 1752(2004) Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 2628(1991; R 1998) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

1.2 GENERAL

All work shall be in accordance with ACI 318/318R.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-05 Design Data

Mix design data shall be submitted in accordance with the paragraph entitled, "Ready-Mix Concrete," of this section.

SD-06 Test Reports

Test reports shall be in accordance with tests as described in the paragraph entitled, "Field Testing," of this section for the following items:

Slump
Concrete Compressive Strength Testing

SD-07 Certificates

Bill of Lading for Ready-Mix Concrete deliveries.

Certificates of compliance shall be provided showing conformance with referenced standards contained in this section for the following:

Proposed Ready-Mix Concrete
Fly Ash
Air-Entraining Admixtures
Steel Reinforcement
Waterstops
Curing Compound

PART 2 - PRODUCTS

2.1 READY-MIX CONCRETE

Concrete shall be ready-mix concrete and mix design data shall conform to ACI 304R.

Concrete elements shall have a 28 day compressive strength of 3000 psi minimum .

Slump: 1 inch to 4 inch according to ASTM C 143/C 143M and ACI 211.1.

Portland Cement shall conform to ASTM C 150, Type I Grey Portland Cement.

One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

Air-Entraining Admixtures shall conform to ASTM C 260. Exterior concrete shall be air-entrained 5 to 6 percent by volume.

Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C 494/C 494M.

Fly Ash used as an admixture shall conform to ASTM C 618, Class A or D (Type E may be used in cold weather upon written approval) with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight.

Ground granulated blast furnace slag used as an admixture s hall conform to ASTM C 989, Grade 120 with between 25 to 50 percent maximum cement replacement by weight.

Transit or shrink-mixed mixing and delivery operations - Conform to ASTM C94. Do not add water at the job unless prior approval is given. Record the amount of any added water on each copy of the delivery ticket. If water is added, mix batch and additional 1 minute per yard of concrete, at slow speed, before placing it. Use no concrete which has been held in a mixer truck longer than 1-1/2 hours.

2.2 STEEL REINFORCEMENT

2.2.1 Deformed Steel Bars

Steel bars shall conform to ASTM A 615/A 615M, Grade 60 ksi and ACI 318/318R.

2.2.2 Welded Wire Fabric

Welded wire fabric shall conform to ASTM A 185.

2.3 FORMS

Forms shall be of wood, steel, or other approved material and shall conform to ACI 318/318R.

Form release shall conform to ACI 347R.

2.4 ACCESSORIES

2.4.1 Curing Compound

Curing compound shall conform to ASTM C 309

PART 3 - EXECUTION

3.1 FORM WORK

Form work shall be in addition to ACI 318/318R, ACI 308R, and ACI 347R.

3.1.1 Preparation of Form Surfaces

Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Exposed joints and exposed edges shall be chamfered. Internal ties shall be so arranged that when the forms are removed, the form ties will be not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

3.1.2 Form Coating

Forms for exposed surfaces shall be coated with a nonstaining form release coating which shall be applied before the steel case is added to avoid contaminating the reinforcing steel. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

3.1.3 Removal of Forms

Forms shall be removed carefully to prevent damage to the concrete. Forms shall not be removed before 24 hours after placing concrete.

3.2 STEEL REINFORCING

3.2.1 General

Reinforcement shall be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.2.2 Fabrication

Steel reinforcement shall be shop fabricated in accordance with ACI 315. Shop details and bending shall be in accordance with ACI 318/318R.

3.2.3 Splicing

Splices shall be in accordance with ACI 318/318R.

3.2.4 Supports

Reinforcement shall be secured in place by the use of metal or concrete supports, spacers, or ties.

3.3 EMBEDDED ITEMS

Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place. Embedded items shall be free of oil and other foreign matter such as loose coatings of rust, paint and scale. Embedding of wood in concrete will be not be permitted

3.4 BILL OF LADING

Bill of Lading for each ready-mix concrete delivery shall be in accordance with ASTM C 94/C 94M.

3.5 CONCRETE CONVEYING

Concrete shall be conveyed from mixers to forms as rapidly as practical by methods that will prevent segregation or loss of ingredients.

3.6 CONCRETE PLACING

3.6.1 General Placing Requirements

Concrete shall be placed in accordance with ACI 318/318R.

Concrete shall be worked into the corners and angles of the forms and around reinforcement and embedded items without permitting the materials to segregate. Concrete shall be placed within 90 minutes after it has been mixed. It shall be placed on clean, damp surfaces free from water, ice, frost, mud, debris, or objectionable coatings. Concrete shall be consolidated with the aid of mechanical vibrating equipment supplemented by handspading and tamping. Vibrating equipment shall be of the internal type.

3.6.2 Hot-Weather Placement

When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R and as specified.

a. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using Liquid nitrogen to cool concrete is Contractor's option.

b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

c. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

d. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Contracting Officer.

3.6.3 Cold -Weather Placement

When cold weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 306R and as specified.

Concrete shall not be placed when the atmospheric temperature is below 40 degrees F or when the concrete is likely to be subjected to freezing temperatures within 24 hours after it has been deposited.

In no case shall concrete be exposed to freezing temperatures for 72 hours after placing. The use of calcium chloride is not permitted.

Cold weather protection in accordance with ACI 306R shall apply to all concrete placements made on this project when atmospheric temperatures are below 50 degrees F.

3.6.4 Structural Concrete - Special Requirements

A. Excavated Areas.

Excavation must be inspected and approved before concrete is placed. If excavations have been carried beyond the level shown on the drawings without approval, fill the extra depth with concrete of the same strength as that required for footings without added cost to the Government. Do not place concrete on wet or soggy ground without first laying and compacting a bed of broken stone or gravel of sufficient thickness, or as indicated on the drawings, to keep the mud from mixing with the concrete. Where water is present, it must be kept below the level of the newly placed concrete continuously during placing and for at least 24 hours thereafter. The excavated area must be so prepared that at least 24 hours thereafter. The-excavated area must be so prepared that the water will easily drain to the pump without carrying any cement with it.

B. Grade Beams and Subgrade Walls.

Place concrete with as few construction joints as possible. Horizontal construction joints are not permitted. Do not place concrete until construction joint bulkhead has been properly installed at predetermined approved locations for stopping work of that day's placing operations. Place concrete continuously without delays or interruptions until entire section between prepared construction joint is placed. Carefully compact concrete to prevent visible voids and honeycombs. Locate reinforcing as required during pour. Dress top of section to a smooth, even surface at proper elevation.

3.7 FINISHING

Defective concrete, voids left by the removal of tie rods, and ridges and local bulging on concrete surfaces permanently exposed to view or exposed to water on the finished structure shall be repaired immediately after the removal of forms. Voids left by the removal of the tie rods shall be reamed and completely filled with dry-patching mortar. Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete secured with keys, dovetails, or anchors. Excessive rubbing of formed surfaces will not be permitted. Unformed surfaces of concrete exposed in the completed work shall have a wood float finish without additional mortar and shall be true to indicated elevations. Other surfaces shall be brought to specified elevations and left true and regular.

3.7.1 Tolerance - Horizontal Surfaces

Conform to ACI 301, Chapter 11, unless modified or exceeded by the following requirements:

Edges of areas shall be level and true to line against forms. Screed surface using specially fabricated straightedges (not lengths of lumber) and wet screeds.

Limit the deviation to slope to:

Tower foundations and concrete pads	1/8" deviation in 5 linear feet
Interior Slab	1/8" deviation in 5 linear feet
Interior slabs covered with thin-set tile	1/8" deviation in 6 linear feet

3.7.1.2 Slopes for Drainage.

Unless shown otherwise, conform to the following: Interior surfaces - 1" in 8'

Where floor drains occur in visible concrete surfaces and in interior concrete slabs to be covered with a finish 7/8" or less in thickness, except where such drains occur in gutters or trenches or where otherwise shown on the drawings, confine the required slope for drainage at the floor drains to a 3' diameter area centered on the drain. Failure to provide required slope shall require that the slab be resurfaced and sloped as directed until it is satisfactory and approved.

3.7.2 Building Slab Finish

A troweled finish shall be applied to floor slab surfaces that are to be exposed to view or covered with resilient flooring, paint, or other finish coating systems.

Final troweling shall be started when a ringing sound is produced as trowel is moved over the surface. Surface shall be consolidated by hand troweling operation. Finished surfaces shall be free of trowel marks, uniform in texture and appearance. Surface defects of sufficient magnitude to show through floor covering shall be removed by grinding.

After slab has been floated, apply hardener topping at the rate of 35 lbs. per 100 square feet using number of applications and finishing procedures recommended by its manufacturer.

3.7.3 Walkway, Tower Foundaiton and Equipment Pad Finish

Trowel finish required for slabs on visible surfaces. Provide Class A horizontal surfaces. Round unchamfered visible edges using 1/2" radius edger

3.7.4 Repair of Defects

Concrete surfaces that are visible, that receive another material as finish or that require rubbed or grout finish shall be free of defects and shall be smooth. Immediately after removal of forms, cut off metal ties, chip out adjacent surface to permit proper patching, cut out honeycomb areas, and remove fins. At holes and cracks, wet surface and point areas flush using 1:3 cement:sand mortar. Cure patch to provide permanent bond.

3.9 CURING AND PROTECTION

Concrete shall be cured in accordance with ACI 308R.

For interior slabs use Moist Curing or Impervious Sheet method. Curing compound may be substituted on interior slabs that are not required to be waterproofed, hardened or finished with topping or mortar bonded terrazzo or tile and if precautions are taken to prevent surface damage from construction operations

Curing shall be accomplished by moist curing, by moisture-retaining cover curing, by membrane curing, or by combinations thereof.

Moist curing shall be accomplished by keeping surface of concrete wet or by covering with absorptive cover saturated with water and kept wet.

Moisture-retaining cover curing shall be accomplished by covering concrete surfaces with moisture-retaining cover for curing concrete.

Membrane curing shall be accomplished by applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared.

3.10 FIELD TESTING

Concrete shall be sampled and tested for quality control during placement. Quality control testing shall be provided by the Contractor.

Sampling of fresh concrete for testing shall be in accordance with ASTM C 172.

Concrete shall be tested for compressive strength at 7 and 28 days for each design mix. Concrete test specimens shall conform to ASTM C 31 and compressive strength testing shall be in accordance with ASTM C 39/C 39M.

Slump shall be tested at the site of discharge for each design mix in accordance with ASTM C 143/C 143M.

Air content for air-entrained concrete shall be tested in accordance with ASTM C 231.

Temperature of concrete at time of placement shall be determined in accordance with ASTM C 1064/C 1064M.

END OF SECTION 03300

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SECTION 13100 – ANTENNA TOWERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following
   1. Erection of the Government Furnished antenna support towers
   2. Installation of RF Cable System
   3. Installation of Tower Lightning Protection System and Grounding

B. Related Sections and documents
   1. Section 03305 – Cast in Place Concrete
   2. Section 16000 - Electrical

1.2 SUBMITTALS

SD-02 Shop drawings

Full tower erection drawings are provided in the invitation for bid set of drawings.

1.3 DELIVERY STORAGE AND HANDLING

Towers will be delivered to the site per specification 011000 and unloaded by the contractor.

Contractor shall inspect and inventory the tower parts. If there are any discrepancies notify the resident enginner so replacement parts may be ordered as soon as possible.

All material shall be handled, stored and protected in a manner to assure its maintenance in good condition.

PART 2 - PRODUCTS

Materials

50' freestanding tower are supplied by Young Manufacturing of Montrose CO. The towers are suppied with anchor bolts for the foundation. Parts for sections of 10 ft. or 20 ft. include, corner angles, cross bracing, ladder and assembly hardware.

PART 3 - EXECUTION

3.1 ERECTION INSTALLATION

Construction procedures and erection sequence shall be consistent with the plans and specifications and shall be designed to result in safe and expeditious completion of the work. Any method of erection which results in permanent deformation or warpage of members will be disallowed. Refer to shop drawings furnished with tower.

All anchor bolt locations and base elevations shall be carefully checked and any errors reported to the Government Representative.

True alignment must be maintained as the work progresses and on completion the tower shall be plumb and true. If the error in alignment and true shape does not exceed 1 part in 200, the structure will be considered in alignment.

All required bolts and fasteners shall be installed and on completion of the structure shall be tight when structural alignment is attained

Normally, nuts will be to the outside of vertical members and on the bottom of horizontal members.

Lock nuts, where required, shall be properly installed.

Members which have suffered damage shall be repaired to "as new" condition before use in the structure. The Contractor shall repair minor damage. Damage to Government furnished material not considered minor shall be immediately reported to the Government Representative and repairs made as directed. Field welding, unless shown on the drawings, will not be permitted without the approval of the Government Representative.

3.2 CONSTRUCTION

3.2.1 Grounding New Tower

Except as otherwise provided on the drawings, at least two legs of the tower shall be grounded by ten-foot ground rods connected to the tower with a minimum #4/0 bare copper wire. Wire shall be exothermically welded to the ground rod below grade and Cadwelded to the antenna tower legs 24 inches above the finished surface of the tower foundation. The ground wire shall be protected by a PVC conduit, in the footing. The ground wires shall be connected to the facility grounding system with the 4/0 BSDC counterpoise to be installed with the coaxial cables as specified elsewhere. Refer to drawings.

3.2.2 Lightning Protection

Lightning protection system for new tower shall be furnished and installed as shown on the contract drawings. Two 4/0 BSDC grounds shall also be installed from the perimeter counterpoise through the foundation and into the fiberglass junction boxes at the base of each antenna tower. The PVC conduit through the foundation shall be extended up into the junction boxes. Leave 24 inches of 4/0 BSDC in each box to be terminated by others.

3.2.3 Cable Installation

Contractor shall install 8 runs of Government furnished 7/8" Andrew LDF5 heliax cable from inside of building, to base of tower, thence up tower to junction box on top of tower. Cable ends shall at all times be protected from the weather and sharp bends in cable shall be avoided. Cable shall be installed inside Government-furnished junction box as shown on the drawings. Coaxial cable shall be run in two of three 4" diameter schedule 40 PVC conduits and the conduit attached to the antenna tower by stainless steel unistrut supports as shown on the drawings. All hardware shall be stainless steel as per the drawings.

3.3 PROTECTION

Upon completion of assembly of tower, but before erection, any and all areas which have had the galvanized finish damaged or otherwise abraded, shall be thoroughly cleaned and sprayed with two coats of cold galvanized spray.

END OF SECTION 13100

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SECTION 16100 – ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following
   1. Installation of the Service Power to the new building.
   2. All interior and exterior wiring.
   3. Installation of the grounding system.
   4. Installation of the Conduits from the building to the towers

B. Related Sections and documents
   1. Section 03000 – Cast In Place Concrete

1.2 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

B. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

C. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.3 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 240 volts, 200 amp, single phase, three wire and 60 Hz service. Final connections to the power distribution system at the existing service pole shall be made by the Contractor

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only

Federal Specifications (FS)

J-C-30	Cable and Wire, Electrical (Power, Fixed Installation)
W-B-30	Ballast, Fluorescent Lamp
W-C-375	Circuit Breakers, Molded Case; Branch Circuit and Service
W-C-586	Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical: Cast Metal For Shore Use
W-J-800	Junction Box; Extension, Junction Box: Cover, Junction Box (Steel, Cadmium or Zinc-Coated)
W-P-115	Panel, Power Distribution
W-S-610	Splice, Conductor

QQ-W-343	Wire, Electrical Uninsulated
WW-C-566	Conduit, Metal, Flexible
W-F-414	Fixture, Lighting (Fluorescent, Alternating Current, Pendant Mounting)

Military Specifications

MIL-P-15147	Primer and Enamel, Coal Tar
MIL-R-21931	Resin, Epoxy

National Fire Protection Association (NFPA) Publications

70	National Electrical Code

National Electrical Manufacturers Association (NEMA) Standards

MG-1	Motors and Generators
NEMA 1	General Purpose Enclosure
NEMA 3	Dusttight, Raintight and □ (Ice) □ Resistant Enclosure
WD1	General Purpose Wiring Devices

Underwriters Laboratories, Inc. (UL) Standards

UL6	Rigid Metal Electrical Conduit
UL50	Cabinets and Boxes
UL98	Enclosed and Dead Front Switches
UL514	Fittings for Conduit and Outlet Boxes
UL542	Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL1242	Intermediate Metal Conduit

1.5 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for the following:

Conduits, Raceway sand Fittings
Wire and Cable
Splices and Connectors
Switches

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Conduits, Raceway sand Fittings
Wire and Cable

Splices and Connectors
Switches

SD-06 Test Reports

Continuity and Insulation Resistance Test
Phase-Rotation Tests
Insulation Resistance Test

SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted.

1.6 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall have the standard finish by the manufacturer when used for most indoor installations. Aluminum shall not be used in contact with earth or concrete and, where connected to dissimilar metal, shall be protected by approved fittings and treatment. Ferrous metals such as, but not limited to, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous spare parts not of corrosion-resistant steel shall be hot-dip galvanized except where other equivalent protective treatment is specifically approved in writing.

1.7 Quality Assurance

Tests

General.- Furnish instruments, materials and labor necessary to perform the following tests. Perform tests in the presence of the COR.

A. Load Balancing.

After the electrical installation has been completed, take current readings with a clamp-on ammeter on each phase of the feeders to each panelboard, and on the main service conductors. Redistribute the loads where greater than a 20 percent difference between readings in any two phases.

If any phase is loaded above 80 percent of the rating of its overcurrent protective device, notify the COR.

B. Insulation Resistance

Feeders and branch circuits shall have their insulation tested after installation, but before connection to fixtures or appliances. Motors shall be tested for grounds or short circuits after installation but before start-up. Conductors shall be free from short circuits and grounds, and a minimum insulation resistance phase-to-phase and phase-to-ground shall be 10 megohms measured with a 500 volt insulation resistance tester.

C. Neutral Isolation

After installation of branch circuits, the neutral in the service entrance switch shall be tested for isolation from ground with an ohmmeter set on its RX1 scale. The incoming neutral shall be temporarily disconnected to accomplish this test. Any contact between the neutral and ground (other than at the service entrance switch) is a possible cause of noise in electronic equipment and shall be corrected.

D. Earth Resistance.

Submit in writing upon completion of the project the measured ground resistance of each ground rod indicating the location of the rod, resistance to ground, and the soil conditions at the time the measurements were made. After ground rods are installed, tie them together with the counterpoise and the resistance to ground of the entire system shall be measured before and after the connection of the earth resistance tester. The maximum ground resistance shall be 10 ohms. Where additional ground rods are required to achieve the specified resistance, the COR shall be notified before proceeding with additional work. The Earth Resistance Test equipment and test procedures shall be by the Biddle Manufacturing Company or equal. Use method B as shown on drawing PBI-D-900764-E003.

E. Operating.

After the interior wiring system installation is completed, and at such time as the COR directs, conduct an operating test. The equipment shall operate in accordance with the requirements of the specification.

PART 2 - PRODUCTS

2.1 Materials

2.1.1 Heavywall Steel Conduit.

Heavywall zinc-coated rigid steel conduit and fittings shall conform to UL 6 and UL 514. Rigid steel conduit may be used in all locations. Coated rigid steel conduit shall be used for installation below slab or grade, or underground. The conduit shall be factory coated with either .008 inch of epoxy resin in accordance with MIL-R-21931, .020 inch of polyvinyl chloride or .063 inch of coal tar enamel in accordance with MIL-P-15147, or field wrapped with .01 inch thick pipe wrapping plastic tape applied with 50 percent overlap. Fittings for use with rigid steel conduit shall be of the threaded type of the same material as the conduit. Where conduits enter boxes or cabinets without threaded hubs, double locknuts shall be used plus a phenolic insulated metallic bushing on the open end.

2.1.2 Intermediate Steel Conduit.

Intermediate zinc-coated rigid steel conduit and fittings shall conform to UL 1242 and UL 514, and bear the UL label. Only factory made sweep ells shall be used. Field bends are not permitted. Fittings shall be of threaded type and of the same material as the conduit. Where conduits enter boxes or cabinets without threaded hubs, use double locknuts and phenolic insulated metallic bushing on each open end.

2.1.3 Flexible Steel Conduit.

Flexible steel conduit shall conform to FS WW-C-566. Use in 18 inch nominal lengths for terminal connections to meters or motor driven equipment, and use in short lengths for other applications as permitted by the NEC. Liquid tight flexible conduit shall be used outdoors or in wet locations. A separate ground conductor shall be provided across all flexible connections in addition to the green ground wire.

2.1.4 Conductors, Uninsulated.

Copper in accordance with FS QQ-W-343.

2.1.5 Conductors, Insulated.

Unless otherwise indicated, insulated conductors shall be copper with thermoplastic or thermosetting insulated, type THW, THWN, and XHHW for general use, or type THHN for use in dry locations only, all insulated for 600V in accordance with FS J-C-30. **Conductors #10 AWG and smaller shall be solid**, and conductors #8 AWG and larger shall be stranded. **Minimum branch circuit conductor size #12 AWG. Minimum control wire size #14 AWG unless noted otherwise**.

2.1.6 Wiring Devices

A. Switches, Safety

Safety switches shall conform to UL 98, heavy duty, unless otherwise indicated. Switches mounted in dry locations shall be in NEMA 1 enclosures. Switches installed outdoors, or in damp or wet locations shall be mounted in NEMA 3R enclosures. Switches shall be of the voltage and current ratings indicated, and each capable of interrupting the locked rotor current of the motor. The locked rotor current is assumed to be 10 times the full rated load current. The switches shall be of the quick-make, quick-break type, parts shall be mounted on insulating bases to permit replacement of any part from the front of the switch. Current carrying parts shall be of high-conductivity copper, designed to carry rated load without excessive heating. Switch contacts shall be silver-tungsten type or plated to prevent corrosion, pitting and oxidation and to ensure suitable conductivity. Safety switches shall be lockable in either position.

B. Device Plates

Plates on unfinished walls and on fittings shall be of zinc coated sheet steel or cast metal having rounded or beveled edges. Plates on finished walls shall be of satin finish chromium plated brass. Screws shall be of metal with counter sunk heads, in a color to match the finish of the plate. The use of sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed. Device plates for telephone and intercommunication outlets shall have a 3/8 inch bushed opening in center or dome shaped grommet on the side. Where required, device plates for telephones may be more than one piece type.

C. Fuses.-

Fuses shall have a voltage rating not less than the circuit voltage. Cartridge fuses shall have an interrupting rating as indicated, but if not indicated shall be not less than 100,000 amps when used in branch and distribution circuits, and not less than 200,000 amps when used in a service entrance switch.

2.1.7 Grounding Electrodes and Conductor

The grounding electrode conductor shall be bare copper. The rods shall be 3/4 inch diameter by 10 feet long copper-clad steel and of the sectional type.

2.1.8 Surge Arrestor.

At Service -120/240 V, 3-phase, 4-wire. EFI Electronics #T40WS120/240Y(GFM).
Splices.- Solderless connectors for splices shall conform to FS W-S-610.

PART 3 - EXECUTION

3.1 Installation

3.1.1 Wiring

General.- In the three wire system specified, not more than one wire from each of the two phases shall be run with a common neutral. Neutral conductors shall extend from the neutral bus in the device where the active conductors originate. Device terminals for connection of more than one conductor shall be specifically designed for that purpose.

3.1.2 Raceways

Minimum conduit size shall be ¾-inch, but may be 1/2 inch for exposed control wiring. Each run shall be complete, fished, and swabbed before conductors are installed. Cap ends of conduit systems not terminated in boxes or cabinets. Exposed raceways structure. A pull wire shall be installed in empty tubing and conduit system in which wiring is to be installed by other trades. The pull wire shall be No. 14 AWG zinc coated steel, or plastic with a minimum 200 pound tensile strength. Ten inches of slack shall be left at each end of the pull wire. Sections of raceways which pass through damp, concealed or underground locations shall be of a type specified for such locations, and extending a minimum of 12 inches beyond the damp, concealed, or underground area.

Where conduit has to be cut in the field, cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The cut ends of the field cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and the same thread dimensions and taper as specified for factory cut threads conduit.

3.1.3 Raceway Support Systems.

Raceways shall be securely supported and fastened in place at intervals of not more than 10 feet and within 3-feet of each outlet box, junction box cabinet or fitting, with pipe straps, wall brackets, hangers, or ceiling trapeze. Fastenings shall be by wood screws, nails or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion-bolts on concrete; by machine screws, welded

threaded studs, or spring tension clamps on steel work. Nail type nylon anchors or threaded studs tension clamps on steel work. Nail type nylon anchors or threaded studs driven in by a power charge and provided with lock washers and nuts may be used instead of expansion bolts or machine or wood screws.

Threaded C clamps with retainer may be used. Raceways or pipe straps shall not be welded to steel structures. In partitions of light steel construction, sheet metal screws may be used. Raceways shall not be supported from sheet metal roof decks.

3.1.5 Splicing

Splices shall be made only at outlets, junction boxes, or accessible raceways. Use compression connectors to splice conductors #8 AWG and larger. Splices shall be taped with electrical insulating tape in a manner which makes their insulation equal on the conductors. For splicing of underground power and control cables, see attached FAA Std-71.

3.1.7 Service Equipment

Service entrance equipment shall be in accordance with the regulations of the local utility providing service and the NEC. The power service entering the building shall have a clockwise phase rotation throughout the building.

3.1.8 Conduits.

Service entrance conduits shall be installed as indicated and shall be heavywall zinc coated rigid steel. Underground service entrance conduits shall be installed a minimum of 2 feet below finished grade.

3.1.9 Disconnect Switch.

Switches used for service entrance disconnecting shall be fused disconnecting type and U.L. approved and labeled for used as service equipment.

3.1.10 Surge Arrestor.

Surge arrester shall be installed adjacent to (within 1 foot) and on the load side of the main service disconnect means as indicated. This arrester shall be compatible with the voltage of the service, and wired in such manner that sharp bends are avoided, keep bends to a minimum. Connect the arrestor as recommended by the manufacturer. Phase lugs shall be connected to corresponding phase terminals of the disconnect switch with insulated No. 4 AWG (minimum) stranded copper color coded cable.

3.1.14 Fuses.

A complete set of fuses shall be installed and one set of spares shall be furnished for each fusible device. Time/current tripping characteristics of fuses serving motors or connected in series with circuit breakers shall be coordinated for the proper operation.

3.1.15 Grounding

A. General. The grounding system shall be installed as indicated. The National Electrical Code shall govern, except where otherwise indicated.

B. Connecting Grounding Systems.

Ground rods shall be interconnected by means of a buried, bare, No. 4/0 AWG copper cable. The cable shall be buried at least 2 feet below grade level or as indicated. Connections to the ground rods shall be made by exothermic welding or an approved type of high compression fitting except in access wells. Connections in access wells shall be made by means of UL approved and labeled connectors. The interconnecting cable shall close on itself forming a complete loop with the ends exothermically welded or connected with an approved pressure connector in an access well. The grounded electrode conductor for the electric service, sized in accordance with the NEC requirement shall be connected to the earth electrode system with a UL approved and labeled connector in an access well. Underground metallic pipes shall be connected to the earth electrode system by means of No. 2 AWG copper cable. Where routed underground, the interconnecting cables shall be bare. All connections shall be exothermically welded except where such welding could be hazardous. In these cases, bolted connections utilizing UL approved connectors shall be made. Bonding jumpers shall be sized to meet or exceed the NEC.

C. Access Well.

The access well shall be provided with a removable cover. The access well shall provide space for testing the earth electrode system, connecting multipoint ground cables and future ground cables to the earth electrode system.

D. Equipment Grounding.

All electrical equipment, including light fixtures and receptacles shall be grounded by means of a separate green insulated ground wire (minimum of #12 AWG) routed within the raceway. The ground conductor shall be connected to the power panel or lighting panel equipment ground bus. All metallic non-current carrying parts of electronic equipment shall be grounded to the grounding system.

E. Primary Power Ground.

Primary power shall be 1 phase, 3 wire, with one wire the neutral. At the service entrance safety switch, the neutral wire shall connect directly to the grounding grid. All AC power distributed from the power distribution panel shall be 3 wire with the neutral isolated from ground.

F. Protection.

Mechanical protection shall be provided for all cables in the ground system where they may be subject to damage. Protection shall be provided by conduit, floor trenches, routing behind permanent structural members, or other practical means. Where routed through metal conduit, bond conduit to the cable at each end.

G. Raceway Ground.

Every component of metallic conduit runs such as individual sections, couplings, line fittings, pull boxes, junction boxes, and outlet boxes shall be bonded to the ground system. Conduit brackets and hangers shall be securely bonded to the conduit and to the metal structure to which they are attached. A #6 conductor shall be continuous in the wireway, and wireways shall be bonded at each joint with a #6 AWG ground conductor.

H. Electronic Ground Conductor.

Electronic ground system is indicated on drawings. Connections of electronic equipment to the electronic ground will be done by others. A multiple point ground (Green/Orange) shall be installed as shown on the drawings.

3.1.16 Identification

A. Nameplates.

Each of the following types of equipment shall be identified with a nameplate which shows the functional name of the unit, voltage utilized, one phase, and any other pertinent information. Switches for local lighting shall not be identified.

Motor controllers
Panel boards
Switches
Self enclosed circuit breakers

Additional units of equipment shall also be identified if called for in the plans. Name plates shall be standard micarte, black with white engraved 3/8 inch minimum height lettering or numerals. The plates shall be secured to the equipment with a minimum of two screws.

B. Color Coding.

Branch circuit and feeder conductors shall be color coded. The color coding shall be continuous throughout the facility on each phase conductor to its point of utilization so that the conductor phase connection is readily identifiable in any part of the installation. The equipment grounding conductor shall be as specified. Neutral conductors shall be continuous white. The neutral of the other systems shall be white with identifiable color tracers (not green). Where color coding is not available in the larger size conductors, the conductors shall be color coded by use of color coded tape, half lapped for a minimum length of 3 inches. Where conductors are color coded in this manner, they shall be color coded in junction and pull boxes, accessible raceways, panelboards, outlets and switches, as well as at terminations. Conductors in accessible raceways shall be coded in such manner that by removing or opening any cover, the coding will be visible.

Phase conductors shall be color coded as follows:

Single Phase 120/ 240 Volts

Phase A - Black
Phase B - Red

C. Conductor Markers.

In addition to color coding, all line, phase, and neutral conductors shall be identified by plastic-coated, self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved by the COR. Panel and circuit numbers shall be identified. Conductor identification shall be provided at terminations, and in junction boxes through which these conductors pass. Control circuit conductor identification shall be made by heat shrink tubing, permanently attached stamped metal foil markers, or equivalent means as approved by the COR. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable.

3.1.17 Cutting and Patching.

Electrical work shall be carefully laid out in advance. Where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, it shall be carefully done. Damage to the building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

END OF SECTION 16100

SECTION 16200 – UNDERGROUND CABLES

PART 1 - GENERAL

Section 16100 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

1.1 SUMMARY

A. This section includes the following
   1. Installation of Conduit and for cable between the Building and Towers
   2. Installation of Telco Conduit
   3. Installation of Conduit and Power Cable between the Building and Transformer

B. Related Sections and documents
   1. Section 02312 Excavation, Backfilling, And Compacting For Utilities
   2. Section 16100 – Electrical Work

1.2 REFERENCES

The publications listed below form a part of this section to the extent referenced:

Federal Specifications (FS)

QQ-W-343	Wire, Electrical Uninsulated

ASTM INTERNATIONAL (ASTM)

ASTM B 3(2001)	Standard Specification for Soft or Annealed Copper Wire

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA TC 2	Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA TC 3	PVC Fittings for Use With Rigid PVC Conduit and Tubing
NEMA TC 6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA RN 1	PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electrical Code 2005 Edition

UNDERWRITERS LABORATORIES (UL)

UL 6	UL Standard for Safety for Electrical Rigid Metal Conduit-Steel
UL 651	UL Standard for Safety Schedule 40 and 80 Rigid PVC Conduit

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for the following items showing manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

Conduit, Raceways and Fittings
Boxes and Fittings

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Conduit, Raceways and Fittings
Boxes and Fittings

PART 2 - PRODUCTS

2.1 CONDUIT, RACEWAYS AND FITTINGS

PVC Conduit

Rigid nonmetallic conduit shall be in accordance with NEMA TC 13 and shall be PVC with wall thickness not less than Schedule 40. Rigid PVC shall be the slip-joint solvent-weld type, and fittings shall be unthreaded solid PVC. Conduit and fittings shall conform to UL 651 and NEMA TC 3.

Conduit shall be 3/4 inch diameter minimum, except where specifically shown smaller on the contract drawings, and except for exposed switch leg runs.

Conduit, connectors, and fittings shall be approved for the installation of electrical conductors.

Heavywall Steel Conduit.

Heavywall zinc-coated rigid steel conduit and fittings shall conform to UL 6 and UL 514. Rigid steel conduit may be used in all locations. Coated rigid steel conduit shall be used for installation below slab or grade, or underground. The conduit shall be factory coated with either .008 inch of epoxy resin in accordance with MIL-R-21931, .020 inch of polyvinyl chloride or .063 inch of coal tar enamel in accordance with MIL-P-15147, or field wrapped with .01 inch thick pipe wrapping plastic tape applied with 50 percent overlap. Fittings for use with rigid steel conduit shall be of the threaded type of the same material as the conduit. Where conduits enter boxes or cabinets without threaded hubs, double locknuts shall be used plus a phenolic insulated metallic bushing on the open end.

2.2 EXTERIOR BOXES

Enclosures used in an exterior environment shall meet the requirements of NEMA 250, Type 4X Stahlin Enclosures Type HWT, Size as indicated on the drawings.

2.2 GROUNDING ELECTRODES AND CONDUCTOR

Conductors shall be bare copper in accordance with FS QQ-W-343.

2.5 GROUND RODS

UL 467. Copper-clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long, unless indicated otherwise.

2.3 CABLE

Government Furnished - 7/8" Heliax LDF5-50A by Andrew Corporation

Max Tensile Strength – 325 lb.
Min Bending Radius - 10 in.

Contractor Furnished – Power Cable as shown in 161000

Unless otherwise indicated, insulated conductors shall be copper with thermoplastic or thermosetting insulated, type THW, THWN, and XHHW for general use, all insulated for 600V in accordance with FS J-C-30. Conductors #8 AWG and larger shall be stranded.

PART 3 - EXECUTION

3.1 UTILITIES TRENCH EXCAVATION AND BACKFILLING

3.1.1 GENERAL REQUIREMENTS

Before starting earthwork, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

Excavation, filling, backfilling, and grading shall be to subgrade elevations specified.

Excavated materials suitable for backfill shall be piled in an orderly manner sufficiently distant from excavations to prevent overloading, slides, and cave-ins.

Excavations shall be done in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

3.1.2 TRENCH EXCAVATION

Trenches shall be of adequate width and depth for the specified purpose. Side slopes of the trenches shall be as nearly vertical as practicable. The trench shall be only as wide as necessary for workers to install the cables or ducts. Care shall be taken not to overexcavate. Bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length. Stones shall be removed, as necessary, to avoid point bearing.

Trenches shall be of a depth to provide a minimum cover over the top of the cables or ducts of 2-feet below finished grade, and at additional depth if necessary to avoid interference of the electrical cables or ducts with other utilities. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6-inches below the trench depth specified. Except as specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench, it shall be removed and the trench shall be backfilled to the proper grade with coarse sand, fine gravel, or other suitable, approved material.

3.1.3 BACKFILLING AND COMPACTION

Trenches shall not be backfilled until required tests are performed and until the utilities systems, as installed, conform to the requirements for the installation of the various utilities. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

A. Bedding

Where the trench is excavated in rocks, a minimum of 6 inches of sand bedding material shall be placed on the rock surface before laying conduit or electrical cable.

B. Backfill Around Conduits

Backfill around conduits shall be applied to 6-inches above conduits with the specified bedding material.

C. Lower Portion of Trench

Backfill material shall be deposited in 8-inch uncompacted layers and compacted to the density of the adjacent soil until there is a cover of not less than 1 foot. The backfill material in this portion of the trench shall consist of sandy clay, sand, gravel, soft shale, or other approved materials, free from hard clods and stones larger than 1 inch in any dimension.

3.1.4 RESTORATION OF SURFACES

Areas within the limits of earthwork under this section, including adjacent transition areas, shall be uniformly graded. The finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.The finished surface of areas to receive topsoil blend shall be not more than 0.10-foot above or below the specified finish elevations.

3.2 INSTALLATION

3.2.1 General

Sizes of conduit shall be as indicated

Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.

The minimum bend radius shall be according to NEC –70 Chapter 9, Table 2 for "Other Bends" for all conduit unless approved by the COR. .

Conduit shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers.

3.2.2 INSTALLATION OF RIGID PVC CONDUIT

Any run of conduit shall contain not more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting. Field bends shall be made in accordance with the manufacturer's recommendations. Installed conduit and fittings shall be free of dirt and trash and shall not be deformed or crushed.

Ends of conduit extending from the interior to the exterior of the building and portions of interior conduit shall be sealed to prevent the passage of air within the conduit. Conduit shall be sloped to drain and shall be provided with drainage fittings at the lower end of the run. Exposed ends of conduit without conductors shall be sealed with watertight caps or plugs. Bushings shall be provided on the open ends of conduit. A nylon pull rope with a tensile strength not less than 130 pounds shall be installed in empty conduit.

Rigid PVC conduit for underground work shall be direct buried as specified for underground ducts or encased in a concrete envelope where shown on the drawings . Where suitable protection is provided, PVC can be run exposed particularly in high corrosion areas.

Conduit shall be securely clamped and supported at least every 10 feet vertically . Stainless Steel pipe straps shall be fastened to unistrut with bolts, screws, and anchors.

3.2.3 INSTALLATION OF RIGID CONDUIT

Underground portions of conduit runs shall be painted with bitumastic or shall be provided with a factory-applied coating of PVC not less than 0.20 inch 5 millimeter thick. Underground conduit encased in concrete does not require a protective coating of PVC. When the factory-applied coating is chosen by the Contractor, any nicks, cuts, or other abrasions shall be wrapped with a single layer of 0.010 inch 0.254 millimeter thick pressure-sensitive PVC tape, half-lapped to obtain a minimum thickness of 0.20 inch 5 millimeter. Couplings shall be wrapped with pressure-sensitive tape, as described above, over the coupling and for 2 inches 50 millimeter on each side of the coupling. When precoated couplings designed for the purpose are used, taping may be omitted provided the manufacturer's adhesive is used between the coating on the coupling and the coating on the conduit. Depth of buried conduit shall be as indicated on the contract drawings.

Exposed ends of conduit without conductors shall be sealed with watertight caps or plugs.

Bushings shall be provided on the open ends of conduit containing conductors. Insulated bushings shall be provided for conduits containing conductors AWG No. 4 5.2 millimeter diameter (AWG No. 4) or larger with an insulating ring an integral part of the bushing.

3.2.4 GROUNDING

Grounding shall be provided in accordance with NFPA 70. Noncurrent-carrying parts of electrical equipment shall be bonded and grounded together.

A continuous, copper ground wire shall be run over the conduit and shall be solidly connected to the building counterpoise at one end and a ground rod at the power pole or the tower cp Ground wires shall No. 4/0 AWG copper cable. The cable shall be buried at least 1 foot below grade. All connections shall be made by exothermic welding .

3.3 INSTALLATION OF CABLE

3.3.1 GENERAL

Raceways shall be completely installed, with interiors protected from the weather, before proceeding with the installation of cables.

Where several cables pass through a common pullbox, the cables shall be tagged to clearly indicate the cable number.

Precautions shall be taken during installation to prevent the cable from being "kinked" or "crushed." A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system.

As the cable is pulled into the conduit it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer.

Dynamometers or load-cell instruments shall be used to ensure that the pulling line tension value and the sidewall pressure value do not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during the installation shall not be such that the cable is twisted or stretched or the cable impedance at any point along the length of the cable is altered.

3.4 FIELD TESTING

Test reports shall be submitted in accordance with referenced standards in this section.

END OF SECTION